

Institute of Risk Management PPP/PFI SIG Meeting

Life Cycle Risks in PPP/PFI Projects

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Structure



- Part 1: Introduction to whole life and methodology
- Part 2: Issues in whole life risks
- Part 3: Lifecycle lessons learned



Part 1:

Introduction to whole life and methodology

Part 1 Outline



The following will be presented in Part 1:

- Background
- Lifecycle methodology
- Service life data
- Expenditure profile & NPV
- Lifecycle options appraisal
- Lifecycle replacement v. maintenance

Background



- Running costs of building having significant impact on occupiers budgets during 1930's (Dale 1993),
- Basing choices of different alternatives on initial construction costs alone was not satisfactory,
- Emergence of a number of recent trends as issues of concern for design professionals;
 - facility obsolescence
 - environmental sustainability
 - operational-staff-effectiveness
 - Total quality management (TQM)
 - Value engineering (VE) (Kirk and Dell'Isola 1995)



- What is Whole Life Costing

BS ISO 15686 Service life planning (BSI 1999):

- 'a tool to assist in assessing the cost performance of construction work, aimed at facilitating choices where there are alternative means of achieving the Client's objectives and where those alternatives differ, not only in their initial costs but also in their subsequent operational costs'



- What is Whole Life costing
 - The systematic consideration of all relevant costs and revenues associated with the acquisition, use and maintenance and disposal of an asset.

Whole Life Costing & Risk



- WLC deals with the future and the future is unknown
- Obtaining the appropriate level of information & data is paramount to mitigating uncertainty / risk
- The treatment of uncertainty in information and data is crucial to a successful implementation of WLC

Lifecycle Methodology



- Based on prediction rather than historic costs
- For each building element/component/location:
 - what maintenance/replacement needed?
 - when/how often?
 - how much of it?
 - at what cost?
- Individual costs can be interrogated and optimised
- Working with client to achieve the optimum spend profile
- Current costs or NPV calculations

“It is always preferable to estimate the costs from first principles and only to use historical cost information as a check”

(OGC Construction Procurement Guide No.7: WLC)

Methodology: Parameters Considered



- Components
- Start / cycle years
- Concession period
- Traffic / usage
- Percentage of work
- LC Preliminaries
- LC Professional fees
- Access costs
- Strip out / preparation
- Out of hours premium
- Health & safety
- Re-commissioning
- Risks
- Overheads & profit
- Inflation
- Interest rate
- Economies of scale

Lifecycle Methodology



Cyril Sweett Consulting - NWDA Sample Model

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	D	E	F	G	J	K	O	P	Q	R
1	ABC PRIMARY SCHOOL									
2	BCIS Element	Component	Description	Work	Start Year	Maint Period	Quantity	Unit	Rate	Basic Cost
13	2C - ROOF	Eaves	Aluminium fascias and soffits with integral gutters	Renew	40	40	282	m	150.00	27,435
14	2C - ROOF	Roof drainage	Aluminium square section rainwater pipes	Overhaul/seal joints	15	15	80	m	25.00	600
15	2C - ROOF	Roof drainage	Aluminium square section rainwater pipes	Replace	60	60	80	m	45.00	600
16	2C - ROOF	Roof coverings	Single ply felt roof covering	Renew covering	25	25	229	m ²	35.00	8,015
17	2C - ROOF	Canopy	Assumed glazed	Overhaul/ renew seals	15	15	58	m ²	25.00	1,450
18	2C - ROOF	Rooflights	Cylindrical roof lights with opening and fixed lights, polyester powder coated	Renew	40	40	1	nr	500.00	500
19	2C - ROOF	Rooflights	Cylindrical roof lights with opening and fixed lights, polyester powder coated	Overhaul/ renew seals	15	15	1	nr	50.00	50
20	2C - ROOF	Rooflights	Glazed roof areas	Renew	40	40	20	m ²	400.00	8,000
21	2C - ROOF	Rooflights	Glazed roof areas	Overhaul/ renew seals	15	15	20	m ²	50.00	1,000
22	2C - ROOF	Rooflights	Double glazed rooflights	Renew	40	40	4	nr	400.00	1,600
23	2C - ROOF	Rooflights	Double glazed rooflights	Overhaul/ renew seals	15	15	4	nr	50.00	200
24	2E - EXTERNAL WALLS	Walls	Terracotta blocks	Repoint	20	40	275	m ²	15.00	4,125
25	2E - EXTERNAL WALLS	Walls	Facing brick/blockwork	Repoint	20	40	579	m ²	15.00	8,685
26	2E - EXTERNAL WALLS	Walls	Render finish (assumed polymer render, through coloured)	Renew	40	40	657	m ²	35.00	22,995
27	2E - EXTERNAL WALLS	Walls	Render finish (assumed polymer render, through coloured)	Patch repair	25	99	657	m ²	35.00	22,995
28	2E - EXTERNAL WALLS	Walls	Render finish (assumed polymer render, through coloured)	Redecorate	15	7	657	m ²	7.00	4,599
29	2E - EXTERNAL WALLS	Walls	Cedar cladding	Renew	40	40	165	m	50.00	8,250
30	2F - WINDOWS & EXTERNAL DOORS	External doors	External glazed double doors	Renew	25	25	6	nr	1,500.00	9,000

Draw AutoShapes

Ready

Start NWDA-WLCguidance-Dr... 12870 LIFE CYCLE WOR... Evaluation Sheet NWDA Sample Model EN 13:16

Lifecycle Methodology



Cyril Sweett Consulting - NWDA Sample Model

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	D	E	F	G	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
1	ABC PRIMARY SCHOOL																	
2	BCIS Element	Component	Description	Work	TOTAL	1	2	3	4	5	6	7	8	9	10	11		
3					ABC PRIMARY SCHOOL	1,209,797					8,976	3,834	15,545	3,834	3,834	29,337	4,538	
6	Sub-Total before Smoothing / Adjustment :				1,209,797					8,976	3,834	15,545	3,834	3,834	29,337	4,538		
76	3B-FLOOR FINISHES	Tile finish	Ceramic tiling	Renew														
77	3B-FLOOR FINISHES	Sheet finishes	Heavy duty stippled vinyl on latex screed	Renew	2,573													
78	3B-FLOOR FINISHES	Sheet finishes	Non-slip vinyl on latex screed	Renew	12,569													
79	3B-FLOOR FINISHES	Sheet finishes	Linoleum on latex screed	Renew	20,497													
80	3B-FLOOR FINISHES	Sheet finishes	Gerfloor sports floor	Renew	8,820													
81	3B-FLOOR FINISHES	Sheet finishes	Carpet	Renew	14,028							3,507						
82	3B-FLOOR FINISHES	Sheet finishes	Carpet	Renew	31,563											10,521		
83	3B-FLOOR FINISHES	Sheet finishes	Entrance Barrier Matting	Renew	14,175											4,725		
84	3B-FLOOR FINISHES	Sheet finishes	Entrance Barrier Matting	Renew	13,230											4,410		
85	3B-FLOOR FINISHES	In-situ finishes	Floor paint	Recoat	966								242					
86	3B-FLOOR FINISHES	Skirtings	Assumed vinyl or timber	Renew	31,500													
87	3C-CEILING FINISH	Ceiling finishes	Mineral fibre tile suspended ceiling with exposed grid	Replace damaged tiles	470					17	17	17	17	17	17	17	17	
88	3C-CEILING FINISH	Ceiling finishes	Mineral fibre tile suspended ceiling with exposed grid	Renew	1,680													
89	3C-CEILING FINISH	Ceiling finishes	Metal perforated liner	Replace damaged tiles	988					35	35	35	35	35	35	35	35	
90	3C-CEILING FINISH	Ceiling finishes	Metal perforated liner	Renew	3,528													
91	3C-CEILING FINISH	Ceiling finishes	Bulkhead	Redecorate	202								50					
92	3C-CEILING FINISH	Ceiling finishes	Plasterboard	Redecorate	26,191								6,548					
93	3C-CEILING FINISH	Ceiling finishes	Plasterboard - school street	Redecorate	2,486								622					
	3C-CEILING FINISH	Ceiling finishes	Plasterboard - main hall	Redecorate	2,974								743					

Ready Sum=0

Start NWDA-WLCguidance-Dr... 12870 LIFE CYCLE WOR... Evaluation Sheet NWDA Sample Model 13:20

Service Life Data



- Client's service life requirement
- Historical replacement records
- Manufacturers and Suppliers
- Trade Associations
- Research Organisations such as BRE, CIRIA
- British and European Standards
- Published research and conference papers such as BMI, CIBSE and HAPM.
- Technical press
- Service Contractor's input

Service Life Data Limitations



- Durability assessment is not an exact science
- Numerous factors interact to determine durability in practice (ISO 15686-1)
- Actual replacement interval often driven by economic, technical or functional obsolescence
- Workmanship, latent defects, training, vandalism, changes in usage volume, climate and maintenance can affect durability
- Durability risks and variability need to be managed

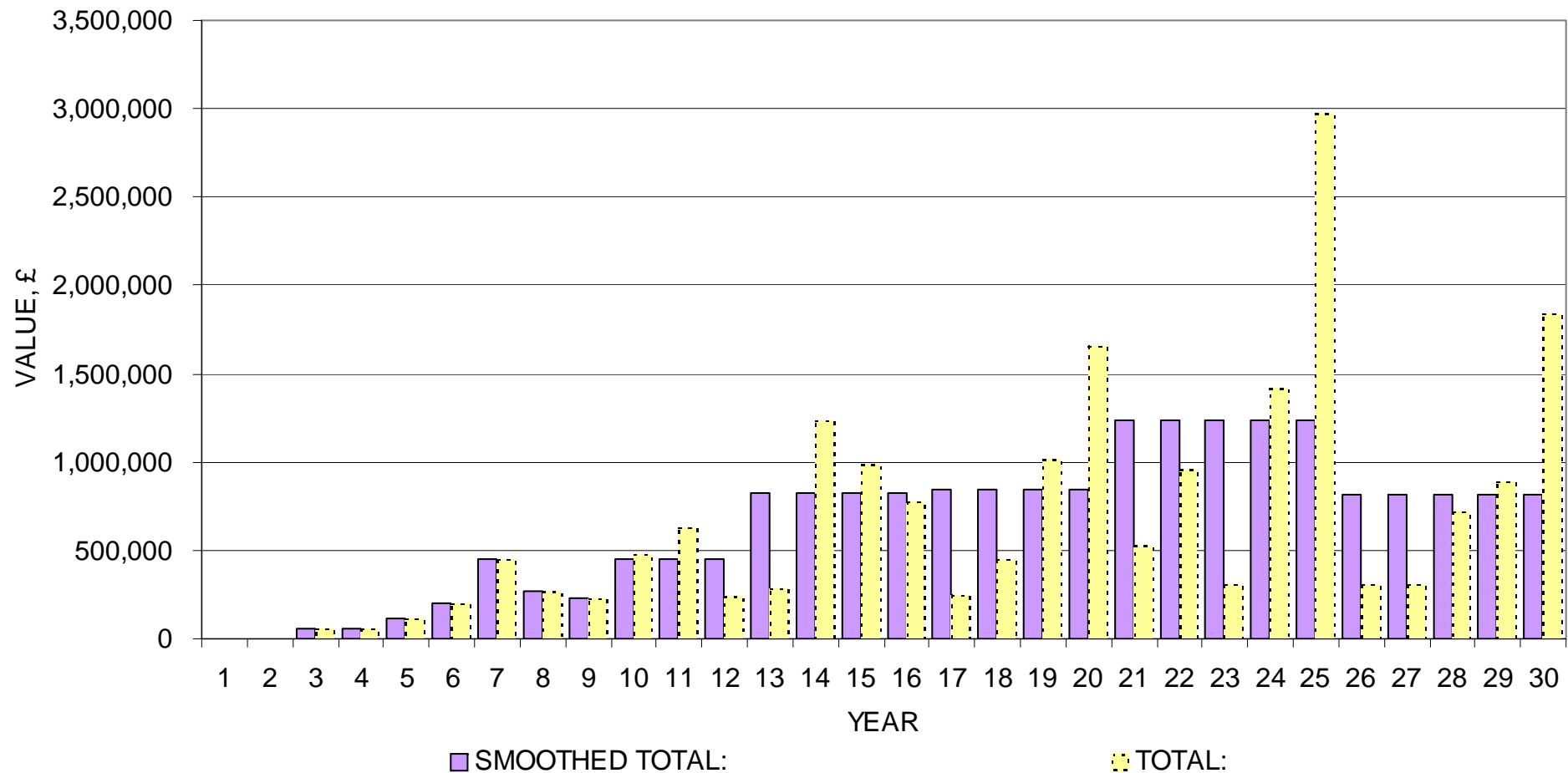


Lifecycle Expenditure Profile



- Spread lifecycle premature failure risks
- Minimise disruption by eliminating peaks and troughs of expenditure
- Optimise funding and cover ratio
- Smoothing can be applied at high level or on individual component, e.g.
 - Internal redecorations profiled as 20% per year rather than 100% every 5 years
 - Flooring renewals to be profiled according to traffic and location

Smoothed Profile Example



Lifecycle Options Appraisal



- LCC used for comparing costs in use of different project options in order to identify best value option
- Typically used for evaluating:
 - Alternative component specification options
 - Newbuild v. refurbishment of buildings
 - Alternative building services systems, including energy costs
 - Cost-benefit analysis to justify expenditure
- Apply the 80/20 rule - focus on components with biggest LCC impact, e.g. claddings, roof finishes, internal finishes, M&E



Lifecycle Option Appraisal Example



LIFE CYCLE OPTION APPRAISAL SUMMARY SHEET

Discount rate: 3.5%, 6%

Analysis based on 10,000m2 building generally except for items marked **

Analysis period: 30 years

 = Best Buy

Element	Component	Capital Cost	30 year LCC (excl. capex)	30 year Capex + LCC	30 year NPV @ 3.5% (incl. Capex)	30 year NPV @ 6.0% (incl. Capex)
Windows	UPVC	600,000	315,000	915,000	725,278	666,698
	Powder coated aluminium	840,000	315,000	1,155,000	965,278	906,698
	Timber (softwood)	450,000	1,252,125	1,702,125	1,035,182	812,146
	Aluminium/timber composite	675,000	626,850	1,301,850	945,696	827,577
Floor coverings	Linoleum	270,000	283,500	553,500	412,477	358,397
	PVC	220,000	462,000	682,000	440,182	356,607
	Rubber	300,000	315,000	615,000	458,308	398,218
	Non-slip PVC (Altro)	300,000	315,000	615,000	458,308	398,218
	Timber laminate	250,000	525,000	775,000	538,682	445,286
	Ceramic/quarry tile	300,000	315,000	615,000	450,124	393,141
	Carpet (grade appropriate for use)	180,000	567,000	747,000	476,308	377,375
Internal doors	Painted ply faced door	15,000	35,448	50,448	34,301	28,178
	Self-finished (lacquered) door	20,000	22,050	42,050	31,324	27,310
Ceilings	Mineral fibre tile suspended ceiling	300,000	441,000	741,000	493,341	410,652
	Metal tile suspended ceiling	450,000	0	450,000	450,000	450,000
	Plaster tile suspended ceiling (self-finished)	350,000	367,500	717,500	480,932	413,985
	Painted plasterboard ceiling	250,000	283,500	533,500	412,056	365,377

Lifecycle Replacement v. Maintenance



- Lifecycle is the replacement of major assets with intermittent cycle
- Require interface between lifecycle replacement and maintenance to avoid double counting or shortfall
- Examples include agreed list, cost capping and/or work percentage threshold

Lifecycle Replacement v. Maintenance



	MAIN ASSET AND SUB-COMPONENT LIFE CYCLE REPLACEMENT	SPARE PARTS AND CONSUMABLES REPLACED AS PART OF FM
	<ul style="list-style-type: none">• Framework,• Variable speed drive controllers, .• Drive motor full assembly.• Supply fan full assembly• Attenuator section.• Supply fan enclosure.• Supply distribution ductwork.• Heating and cooling batteries.• Heating and cooling control valves and actuators.• Direct and indirect storage and non storage humidifier devices.• Direct and indirect storage and non storage humidifier control valves and actuators• Mechanical separators• Heat exchangers.• Air terminal supply diffusion device including hoods and canopies.• Air terminal supply regulation device• Fire and control dampers/actuators.	<p>Filters, valves repair kits, drive belts, fan bearings, drive couplings, switches, seals, electric heating elements, lubricants, lamps, manometer fluid, panel gaskets, glass traps, chemicals. Fuses, miniature circuit breakers, residual current devices, isolators, contactors, contacts, over current devices, auxiliary contacts, relays, timers, lamps, push buttons, solenoid valves, interlocks, seals, lubricants, impellers, fasteners, belts, drive couplings, mechanical seals, stuffing box packing, anti vibration mounting pads, air-flow temperature/static pressure sensors</p>

Summary



- WLC was borne from the realisation that running costs were having significant impact on occupier's budgets
- WLC is the systematic consideration of all relevant costs and revenues, associated with the acquisition, use and maintenance, and disposal of an asset
- Successful implementation of WLC is linked to treatment of uncertainty in information and data.

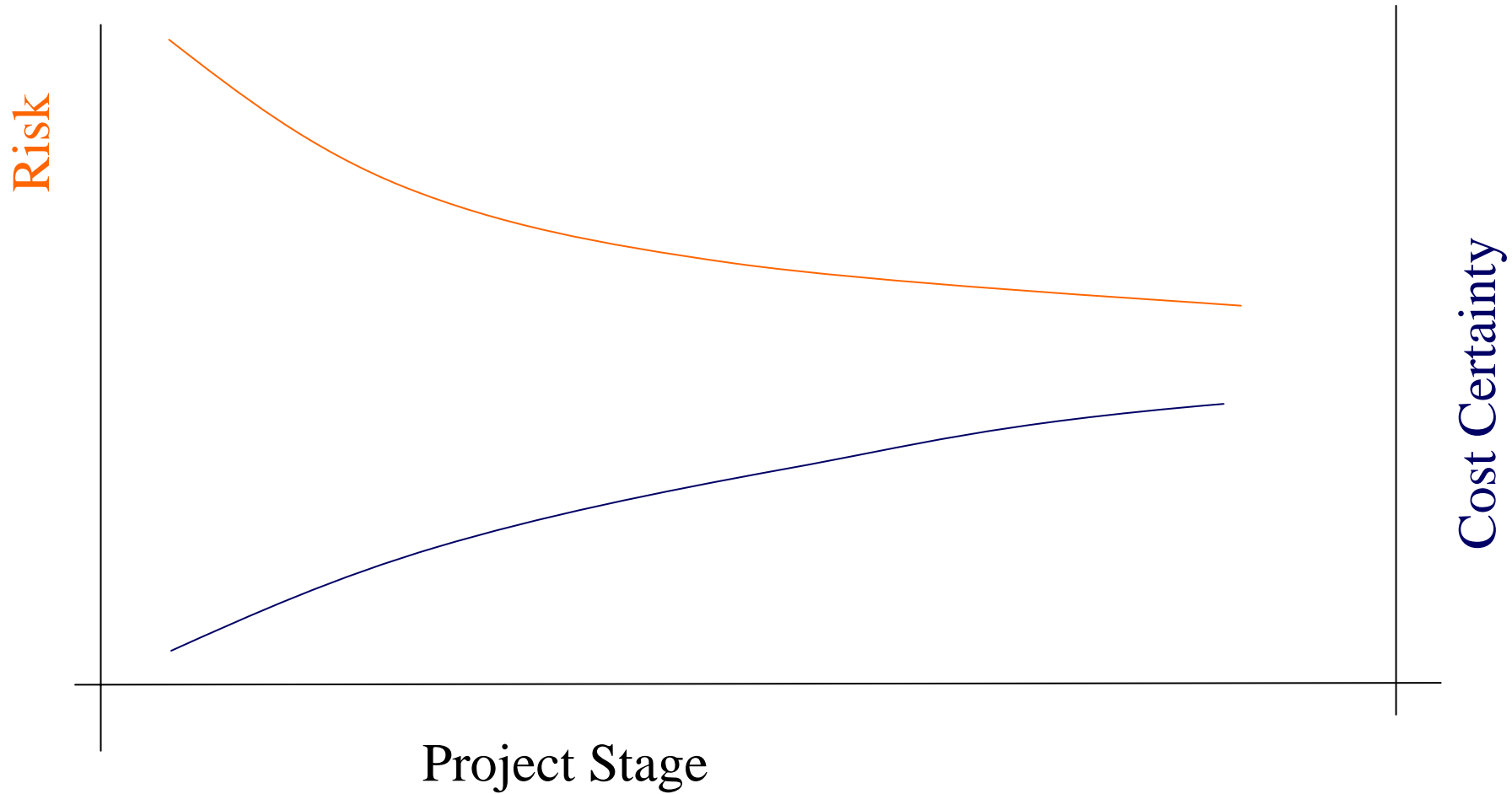
Part 2: Issues in whole life risks

PFI Project Stages



- OJEC
- Pre Qualification
- Invitation to Tender
- Invitation to Negotiate
- Competitive Dialogue
- BAFO
- Preferred Bidder
- Financial Close
- Construction
- Operation

PFI Project Stages



Issues that Effect Whole Life Cost



- What Puts Lifecycle At Risk – before Financial Close?
- Inputs to Lifecycle Model
 - Cost Plan
 - “Add-on” Structure
 - Project Agreement
 - Concession Period
 - Inflation
 - Hand back Requirements
 - Equipment Durability / Service Life
 - Retained Assets

Issues that Effect Whole Life Cost



- **What Puts Lifecycle At Risk – During Construction?**
 - Supply Chain Management
 - Quality of Build
 - Design Changes
 - Maintenance
 - Usage by Customer

Issues that Effect Whole Life Cost



- **What Puts Lifecycle At Risk – Operation Phase?**
 - Variations
 - Maintenance
 - Usage by Customer
 - Vandalism

What Puts Lifecycle At Risk ? – Cost Plan



- Cost plan accuracy linked to design level
- “Provisional sums” rather than firm tender prices
- May be based on incorrect assumptions
- Cost Base – period may change
- Time delay between Financial Close and end of construction
- Any errors or omissions in cost plan effects lifecycle.

What Puts Lifecycle At Risk ? – “Add Ons”



- Lifecycle models anticipate future costs of asset replacements
- Possible constituents:
 - Prelims
 - BWIC
 - M&E Commissioning
 - Access (where applicable)
 - Out of Hours Premium
 - Escort Costs
 - FM Management
- Assumptions made before SPV organisation set-up

What Puts Lifecycle At Risk ? – PA



- Must define the scope of the lifecycle fund
- Must define the interface between FM and lifecycle (threshold value)
- Payment Mechanism – defines potential deductions
- Defines “residual value” or handback requirements

What Puts Lifecycle At Risk ? – Period



- Lifecycle models should be based on the anticipated concession period, any changes should be incorporated
- Concession period may be reviewed as part of refinancing
- Lifecycle should be remodelled – the expenditure profile is not “linear”
- Significant replacements may be required beyond 25 years

What Puts Lifecycle At Risk ? – Inflation

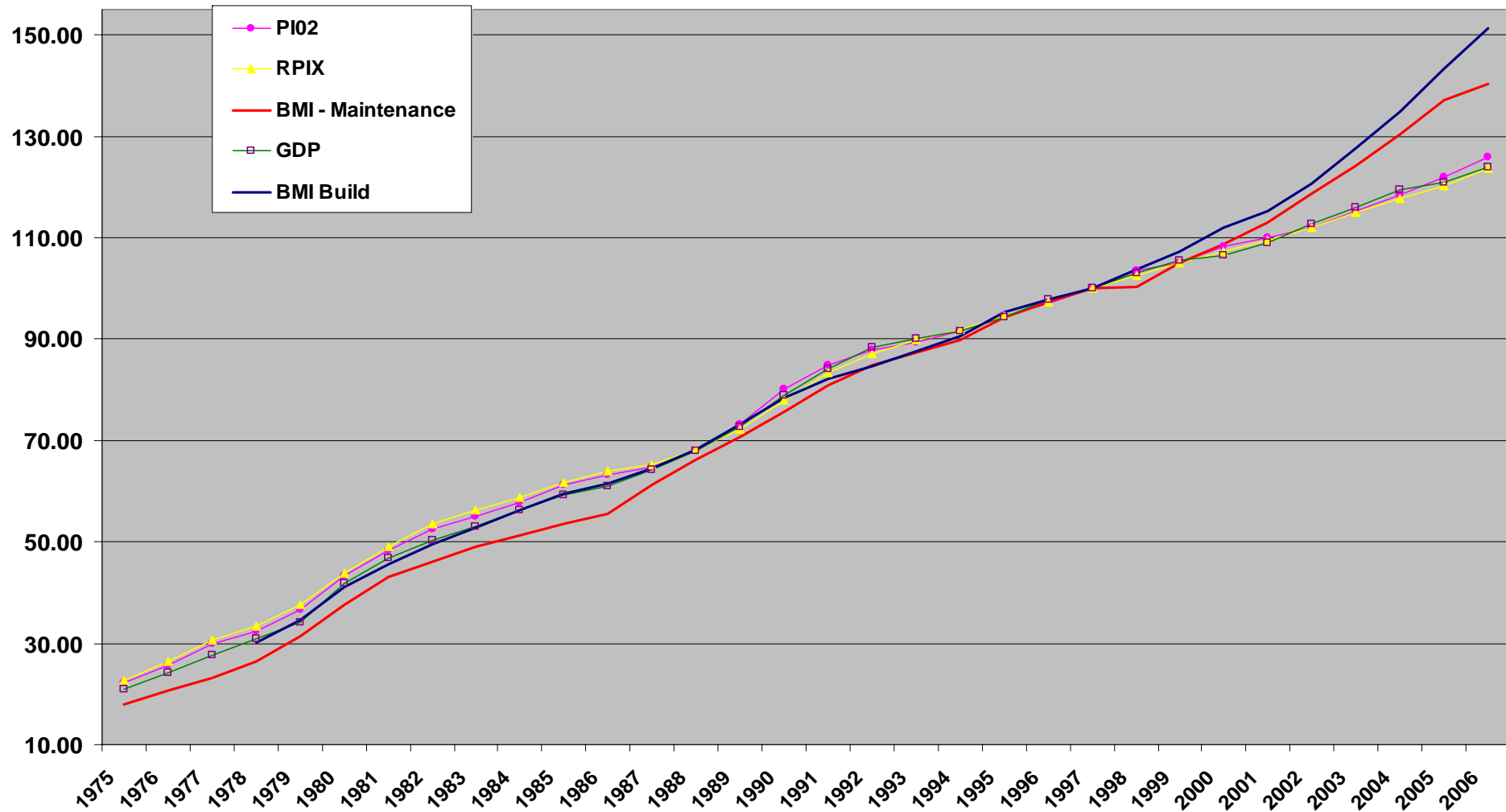


- Modelled in “real” cost
- Inflation added in the financial model
- Many models use basic RPI as the inflation factor
- Building costs effected by different index.
- Expenditure should be regularly reviewed against forecast.

What Puts Lifecycle At Risk ? – Inflation



Various Cost Indices (1997=100)



What Puts Lifecycle At Risk ? – Handback



- Some PFI projects specify rigid “hand back” requirements.
- These define a “residual life expectancy” in assets in the end of the concession
- Generally a range of values for building components and M&E
- Extreme example was that all escalators in the London Underground PPP should have 50% residual like.
- If this is a defined requirement, provisions should be made in lifecycle

What Puts Lifecycle At Risk ? – Retained Assets



- Some PFI projects include “retained assets”.
- Partial or full refurbishment ?
- Assessment of replacements based on condition surveys.
- Risk is that assets assumed to be in better condition.



- **What Puts Lifecycle At Risk – During Construction?**
 - Supply Chain Management
 - Quality of Build
 - Design Changes
 - Commissioning (M&E)



- **What Puts Lifecycle At Risk – During Operation?**
 - Variations
 - Maintenance
 - Usage by Client

Part 3: Lifecycle Lessons Learned

Lifecycle Lessons Learned



- Use Cost/m² pa or Lifecycle/Capex Ratio appropriately
- Design and costs monitoring from early stages
- Survey retained estate / items including asbestos, DDA, fire, and Part-L2
- Agree LC-FM interface upfront to avoid double or non inclusion
- Spread the replacement works where possible to allow for premature failure and minimise disruption
- Review backend optimisation and hand back requirements
- Operation stage – information, update, current trends, audit and market testing

Classic Lifecycle Myths



- The answer is “42”
- There are only 10 digits (0-9), the answer is how you arrange them
- The answer is depend on number of buses pass-by
- Lifecycle is an estimate upon prognostication upon a guess
- The lifecycle is based on a crystal ball



Thank you

Questions and Discussions